930.01 General

Most railroads in Washington were in operation long before our system of roads was developed and generally have prescriptive rights and underlying property interests that supersede those of road authorities. In general, right of way is not acquired in fee from a railroad company. Rather than selling property, railroads typically convey easements, access rights, and construction permits. Therefore, most roads exist on railroad property by easement from the railroads. Any widening or realignment of an existing roadway, construction upon, over or under, or installation of wires or pipes on railroad property requires permission from the railroad in the form of a permit or an agreement.

Projects that require the railroad to do work, or for which they are to be reimbursed or compensated will require an agreement. It is not unusual for a railroad agreement to take 6 months or more to be developed, reviewed and executed, therefore, it is important for the designer to establish early contact with the HQ WSDOT Railroad Liaison in the Design Office.

Agreements are developed and negotiated by the WSDOT Railroad Liaison. Permits are typically acquired directly from the railroad or its property manager by the Region. Contact your Regional Utilities Engineer or the HQ Railroad Liaison for assistance. Include copies of any executed permits or agreements in the Design Documentation Package. Include a copy of the "Notice to Proceed" (required in the agreement to authorize the railroad to commence work) in the Project file.

Railroad grade crossings are, in effect, intersections with two legs of rail traffic that never stop. Due consideration must be given by the roadway designer to the traffic control for the rail crossing. Grade crossing traffic controls (railroad signals, gates, pavement markings, signs, and controllers) are typically located within the area of railroad property. Railroad signal and gate maintenance is the responsibility of the railroad. Railroads are also responsible for the maintenance of crossing surfaces for the 12 inches outside the edge of rail (WAC 480-62-225). Most railroads will insist on designing and constructing their own signals, gates, and crossing surfaces.

The Washington Utilities and Transportation Commission (WUTC) has statutory authority over grade crossing safety in Washington State. Any changes to a grade crossing or the associated safety appurtenances require initial approval by the WUTC. This is accomplished by submitting a Petition to the WUTC. The Railroad Liaison has copies of WUTC forms and can help with their preparation. The WUTC will review the Petition and issue an Order granting or denying the Petition with or without conditions, depending on situation. Include a copy of any Petition or Order in the Design Documentation Package.

930.02 References

Manual on Uniform Traffic Control Devices for Streets and Highways, USDOT, FHWA, including the *Washington State Modifications to the MUTCD*, WSDOT (MUTCD) http://www.wsdot.wa.gov/biz/trafficoperations/mutcd.htm

Railroad-Highway Grade Crossing Handbook, FHWA TS-86-215

Guidance On Traffic Control Devices At Highway-Rail Grade Crossings, HIGHWAY/RAIL GRADE CROSSING TECHNICAL WORKING GROUP (TWG), FHWA, November 2002 (http://safety.fhwa.dot.gov/media/twgreport.htm#2)

Agreements Manual, WSDOT M22-99

Traffic Control Devices Handbook, ITE, 2001.

A Policy on Geometric Design of Highways and Streets, AASHTO, 2001

Revised Code of Washington (RCW) 81.53 Railroad Crossings

Washington Administrative Code (WAC) 480-62-150 Grade crossing petitions

930.03 Plans

Include plans for state constructed improvements to existing crossings and any new crossings within the normal process. In addition to basic roadway dimensions, signs, and markings, indicate angle of the crossing, number of tracks, location of signals and other railway facilities (e.g., electrical and communications lines, control boxes). Also indicate railroad stationing at the point where highway centerline crosses the center of the tracks.

For any project proposing to alter the horizontal or vertical alignment at a grade crossing (including grade separations), show the alignment and profile for both the railroad and the roadway for a minimum of 500 feet on all legs of the crossing. Show all other important features that might affect the safety, operation, and design of the crossing such as nearby crossroads, driveways or entrances, buildings, and highway structures on the plans.

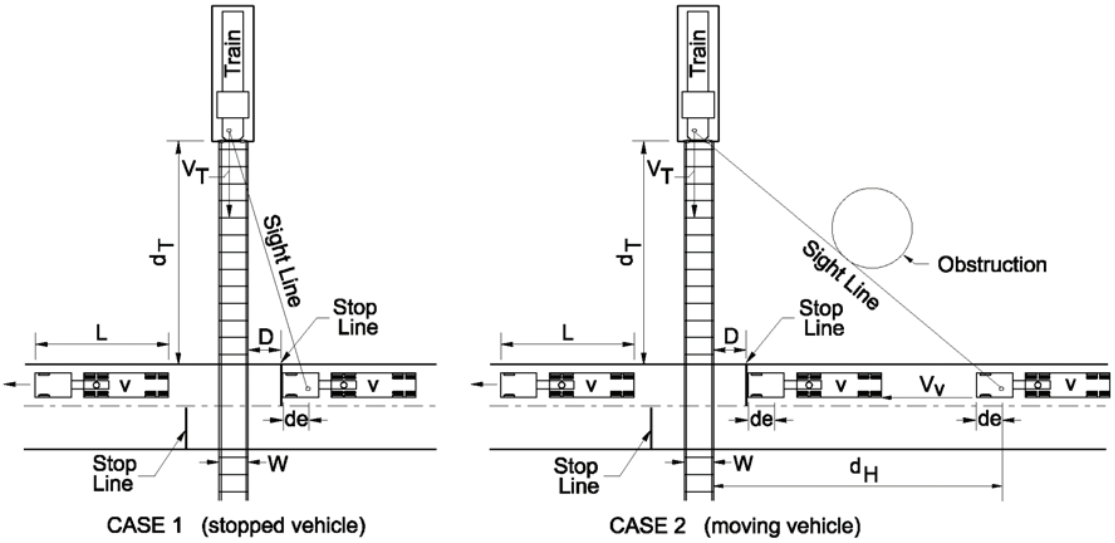
Sight distance is a primary consideration at grade crossings. A railroad grade crossing is comparable to the intersection of two highways where a sight triangle must be kept clear of obstructions or it must be protected by a traffic control device. The desirable sight distance allows an approaching driver to see an approaching train at such a distance that the vehicle can stop well in advance of the crossing if signals or gates and signals are not present. See Figures 930-1, Case 2 and 930-2. Sight distances of the order shown are desirable at any railroad grade crossing not controlled by railroad signal lights or gates (active warning devices).. Their attainment, however, is often difficult and impracticable due to topography and terrain. Even in flat open terrain, the growth of crops or other seasonal vegetation can create a permanent or seasonal sight distance obstruction. Furthermore, the properties upon which obstructions might exist are commonly owned by the railroad or others. Evaluate installation of active devices at any location where adequate sight distances cannot be assured. Include communication with the railroad and Washington Utilities and Transportation Commission in your evaluation.

The driver of a vehicle stopped at a crossing with signal lights but no gates needs to be able to see far enough down the tracks from the stop bar to be able to safely cross the tracks before a train, approaching at maximum allowable speed, reaches the crossing. See Figures 930-1, Case 1 and 930-2.

In some cases lights and gates alone will not provide adequate safety for motorists whose impatience may encourage them to drive around a gate. Evaluate train and traffic volumes and accident history to assess the feasibility of installing a median separator to prevent vehicles from driving around gates. Close call incident logs are sometimes available from the railroad or WUTC, these too can provide an indication of need for additional active control devices. Consult with the railroad or the HQ Railroad Liaison since the railroad may have information on numbers of gate violators at the crossing. Where sufficient space is available, median separators should be at least 60 feet in length.

Construct highway grades so that low-slung vehicles will not hang-up on tracks or damage them. See Chapter 630 for information on vertical alignment at railroad grade crossings. Whenever possible design the roadway to cross grade crossings at right angles. If bicycle traffic uses the crossing (this can be assumed for most roads), provide a shoulder through the grade crossing at least as wide as the approach shoulder width. If a skew is unavoidable, wider shoulders may be necessary to permit bicycles to maneuver to cross the tracks at right angles. See Chapter 1020 for information on bikeways crossing railroad tracks.. Consider installation of advance warning signs indicating the presence of a skewed crossing for crossings where engineering judgment suggests a benefit.

Include any engineering studies or sight distance measurements in the Design Documentation Package.



d_T = Sight distance along railroad tracks
d_H = Sight distance along highway
d_e = Distance from driver to front of vehicle (assumed 8 ft.)
D = Distance from stop line to nearest rail (assumed 15 ft.)
W = Distance between outer rails (single track W=5 ft.)

V_V = Velocity of vehicle
f = Coefficient of friction
V_T = Velocity of train
L = Length of vehicle (assumed 65 ft.)

Adjustments must be made for skew crossings.
Assumed flat highway grades adjacent to and at crossings.

Sight Distance at Railroad Crossing
Figure 930-1

Case 1 Departure from stop		Case 2 Moving Vehicle						
Train Speed (mph) V_T	0	Vehicle Speed (mph) V_V 10	20	30	40	50	60	70
		F=0.40	0.40	0.35	0.32	0.30	0.29	0.28
		Distance Along Railroad from Crossing d_T(ft)						
10	240	150	100	100	100	110	120	130
20	480	290	210	200	210	220	240	270
30	720	440	310	300	310	340	370	400
40	960	580	410	390	410	450	490	540
50	1200	730	520	490	520	560	610	670
60	1440	870	620	590	620	670	730	810
70	1880	1020	720	690	720	790	860	940
80	1920	1160	830	790	830	900	980	1070
90	2160	1310	930	890	930	1010	1100	1210
		Distance Along Highway from Crossing d_H(ft)						
		69	135	220	324	447	589	751
Required design sight distance for combination of highway and train vehicle speeds; 65 ft truck crossing a single set of tracks at 90°. (AASHTO)								

Sight Distance at Railroad Crossing
Figure 930-2

930.04 Traffic Control Systems

Traffic control systems permit safe and efficient operation of railroad-highway traffic crossings. These systems may include one or more of the following:

(a) Passive Elements

(1) Signing elements are shown in Part 8, *Traffic Control for Highway-Rail Grade Crossings*, of the MUTCD and include one or more of the following:

a. Railroad Crossing Sign (crossbuck). The railroad is responsible for maintenance of the crossbucks.

b. Railroad Crossing Auxiliary Sign (Inverted "T" sign). This sign is mounted below the crossbuck to indicate the number of tracks when 2 or more tracks are involved -- Railroad Responsibility.

c. Railroad Advance Warning Sign. Road Authority installs and maintains.

d. Exempt Crossing Sign. This is a supplemental sign that, when authorized by the WUTC, may be mounted below the crossbuck. When this sign is approved, certain classes of vehicles, otherwise required to stop before crossing the tracks, may proceed without stopping, provided no train is approaching. Road Authority installs and maintains.

e. Do Not Stop On Tracks Sign. Road Authority Responsibility.

(2) Pavement Markings on all paved approaches are the responsibility of the road authority and consist of RR Crossing markings per the Standard Plans, no passing markings and pullout lanes as appropriate.

(3) Consider the installation of illumination at and adjacent to railroad crossings where an engineering study determines that better nighttime visibility of the train and the grade crossing is needed. For example:

- where a substantial amount of railroad operations are conducted at night.
- where grade crossings are blocked for long periods at night by slow speed trains.
- where crash history indicates that drivers experience difficulty seeing trains during hours of darkness.

(b) Active Elements

(1) Railroad Signals and gates. Maintenance of these devices is the responsibility of the railroad. Funding for installation and upgrades to these devices, commonly comes from the road authority.

(2) Repeater Signals (also known as "pre-signals"). These are traffic signals installed in advance of a railroad grade crossing when the grade crossing is adjacent to a parallel roadway with a far side traffic signal. They are installed and maintained by the road authority and used to discourage traffic from stopping on the tracks.

(3) Locomotive Horn. By law, trains are required to sound their horn in advance of grade crossings. In some locations this can be a problem for adjacent residents or businesses. This requirement may be waived provided current Federal Railroad Administration (FRA) requirements are met. (See Federal Register Vol 68, Number 243, Dec. 18, 2003) and (http://www.fra.dot.gov/Content3.asp?P=1318).

(4) Traffic signal interconnects (also known as "railroad pre-emption") provide linkage between the railroad signals and adjacent traffic signals to prevent vehicles from getting trapped at a traffic signal as a train approaches. These are typically funded by the road authority and require cooperation with the railroad for installation. Include copies of any signal pre-emption timings or calculations in the Project File.

In general, passive controls notify drivers that they are approaching a grade crossing and should be on the lookout for trains. Passive controls are typically found at low (train) volume and (train) speed crossings.

For crossings of state highways with low to moderate train speeds and volumes or for crossings with limited sight distance per Figure 930-1 Case 2 consider active controls. For crossings without adequate stopped vehicle sight distance per Figure 930-2, Case 1, consider including gates.

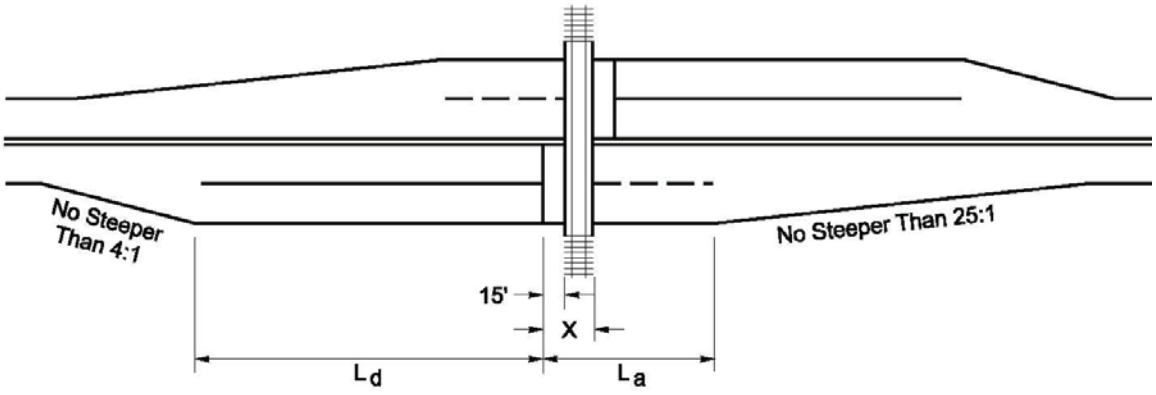
At the time of this writing no National or State warrants have been developed for installation of traffic controls at grade crossings. Furthermore, due to the large number of significant variables that must be considered, there is no single standard system of active traffic control devices universally applicable for grade crossings. Base the determination of the appropriate type of traffic control system on an engineering and traffic investigation including input from the railroad and the WUTC. Significant factors to consider are train and highway volumes and speeds, pedestrian volume, accident history, and sight distance restrictions.

Evaluate railroad signal supports and gate mechanisms as roadside hazards. Use traffic barrier or impact attenuators as appropriate per Division 7 of this manual.

930.05 Pullout Lanes

Per RCW 46.61.350 certain vehicles are required to stop at all railroad crossings without signals or not posted with an “Exempt” sign. Consider the installation of "pullout lane" when grade crossings have no active protection. Some school districts have a policy that school buses must stop at all grade crossings regardless of the type of control. Consider the installation of pullout lanes at any public grade crossing used regularly by school buses and for which the school buses must stop.

Design pullout lane geometrics in accordance with Figure 930-3. The minimum shoulder width adjacent to the pullout lane is 3 feet.



L_d = Total length of pullout lane, approach
L_a = Total length of pullout lane, exit
X = Distance from stopping point to downstream side of crossing surface

Approach Length of Pullout Lane, L_d		Downstream Length of Pullout Lane, L_a	
Vehicle Speed (mph)	Length (ft)	Vehicle Speed (mph)	Length (ft)
30	175	30	0
40	265	40	80
50	385	50	460
60	480	60	870

Typical Pullout Lane at Railroad Crossing
Figure 930-3

930.06 Crossing Surfaces

Railroads are responsible for the maintenance of crossing surfaces up to 12 inches outside the edge of rail (WAC 480-62-225). Crossing surfaces can be constructed of a number of different materials including asphalt, concrete, steel, timber, rubber, or plastic. The most common surface types used on state highway crossings are asphalt, precast concrete, and rubber. Timbered crossings are frequently used for low volume roads and temporary construction crossings.

The life of a crossing surface depends on the volume and weight of highway and rail traffic using it. Highway traffic not only dictates the type of crossing surface but also has a major influence on the life of the crossing. Rough crossing surfaces impact the motoring public far more than the railroad. Therefore, when a highway project passes through a railroad grade crossing consider the condition of the crossing surface. While the existing condition might not warrant railroad investment in replacing it, the surface might have deteriorated sufficiently to increase vehicle operating costs and motorist inconvenience. In such cases it may be effective to partner with the railroad to replace the crossing as part of the highway project. Such partnerships typically consist of the state reimbursing the railroad for all or a portion of the cost of the work.

930.07 Crossing Closure

The MUTCD states, "Any highway-rail grade crossing which cannot be justified should be eliminated". Coordination with the appropriate railroad and the Washington Utilities and Transportation Commission is required before any changes can be made to track structure or railroad signal systems. If a state route grade crossing appears unused, consult the Headquarters Railroad Liaison Engineer before taking any action. At-grade crossings which are replaced by grade separations should be closed.

930.08 Traffic Control During Construction And Maintenance

Work Zone Traffic Control at highway-rail grade crossings is required as in any other project with the addition of the need to provide protection from train traffic. When highway construction or maintenance activities will affect a railroad crossing, the railroad company must be notified at least ten days before performing the work (WAC 480-62-305 (4)). Furthermore, any time highway construction or maintenance crews or equipment are working within 25 feet of an active rail line or grade crossing, consult the railroad to determine if a railroad flagger is required to ensure work zone safety. Current contact numbers for railroads may be obtained by contacting your Regional Utilities Engineer. Railroad flaggers differ from highway flaggers in that they have information on train schedules and can generally communicate with trains by radio. When flaggers are required, the railroad generally sends the road authority a bill for the cost of providing this service.

Work zone traffic must never be allowed to stop or queue up on a nearby rail-highway grade crossing unless railroad flaggers are present. Without proper protection, vehicles might be trapped on the tracks when a train approaches. See the MUTCD for more detailed guidance.

For projects requiring temporary access across a set of railroad tracks, contact the Headquarters Railroad Liaison Engineer early in the design process since a Railroad Agreement will likely be required.

930.09 Railroad Grade Crossing Petitions And WUTC Orders

The Washington Utilities and Transportation Commission (WUTC) is authorized by statute (Title 81 RCW) with regulatory authority over railroad safety at grade-crossings. Any modifications to grade crossings or safety equipment including grade separations, widening, realignment, and profile must be approved by the WUTC (WAC 480-62-150). This is accomplished by submitting a formal Petition to the WUTC for which they will issue a formal Order. Provide Section, Township, & Range; posted speed limit;

ADT, percentage of trucks; number of daily school bus trips; and a 20 year projection of the ADT, truck percentage, and school bus trips. The Headquarters Railroad Liaison Engineer can help in the preparation and submittal of this petition. Include a copy of the Petition and WUTC Findings and Order in the Design Documentation Package.

930.10 Section 130 Grade Crossing Improvement Projects

WSDOT Highway and Local Programs administers the Section 130 Grade Crossing safety improvement program. Project proposals are submitted by local agencies, railroads, and WSDOT. Funding is provided from the Surface Transportation 10 percent "Safety Set Aside" authorized by the TEA-21.

Eligibility: All public railroad grade crossing safety improvements are eligible for funding. Project types include signing and pavement markings; active warning devices; illumination; crossing surfaces; grade separations (new and reconstructed); sight-distance improvements; geometric improvements to the roadway approaches; and closing and/or consolidating crossings. Section 130 funds are generally available at a 90 percent Federal share and up to 100% for signing; pavement markings; active warning devices; elimination of hazards; and crossing closures.

Most Section 130 projects on state highways are low cost grade crossing signal upgrades entirely within existing railroad right of way. Work is typically done by the railroad under agreement and generally takes a very short time. Consider Section 130 grade crossing signal upgrade projects, constructed by the railroad or its contractor, which are not part of a larger state highway project to be Minor Operational Enhancements funded under Program Q barring extenuating circumstances.

Contact the Railroad Liaison in the HQ Design Office for more information.

930.11 Light Rail

Light Rail, also known as streetcars, is developing in some urban areas of the state. For the most part, criteria for light rail are very similar to those for freight and passenger rail with the exception of locations where light rail shares a street right of way with motor vehicles. The MUTCD now includes a chapter devoted exclusively to Light Rail. Consult this reference as the situation warrants http://mutcd.fhwa.dot.gov/HTM/2003/part10/part10-toc.htm.

930.12 Documentation

A list of the documents that are required to be preserved in the Design Documentation Package (DDP) and the Project File (PF) is on the following website:

http://www.wsdot.wa.gov/eesc/design/projectdev/